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(71) Applicant(s)
Ford Motor Company Limited

(Incorporated in the United Kingdom)

Eagle Way, BRENTWOOD, Essex, CM13 3BW, United Kingdom

(72) Inventor(s)
Thomas A Spoto
Hiroshi Higashide
James S Rankin

(74) Agent and/or Address for Service
A Messulam & Co
24 Broadway, LEIGH-ON-SEA, Essex, SS9 1BN, United Kingdom

(54) **Expert system for presenting multimedia information in a tree structure.**

(57) The system uses multimedia information tools (i.e. graphics, documentation, drawings, photographs, full motion video with audio, PLC ladder, etc.) and techniques to assist maintenance personnel. Diagnostic development and multimedia information assignment are accomplished through graphical visual programming, which requires no conventional software programming. The system uses diagnostic trees having multimedia graphic icons which define the diagnostic components. In developing a visual diagnostic tree, the multimedia information can be assigned or mapped to each node of the tree by selecting an appropriate icon to represent the multimedia from an icon library. Then, an appropriate media information file or record and comments for that icon are added. The system uses conventional hardware and can be used on the plant floor.

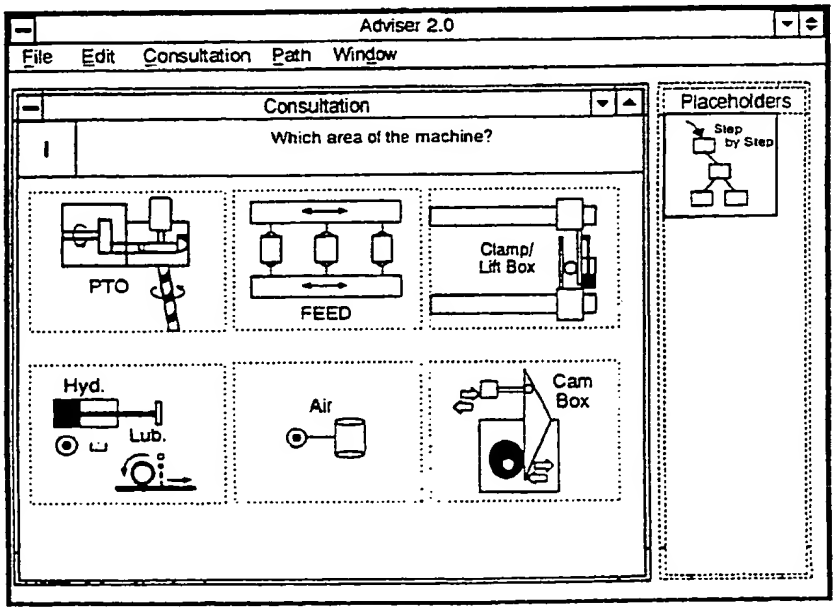

Fig. 8

GB 2 271 005 A

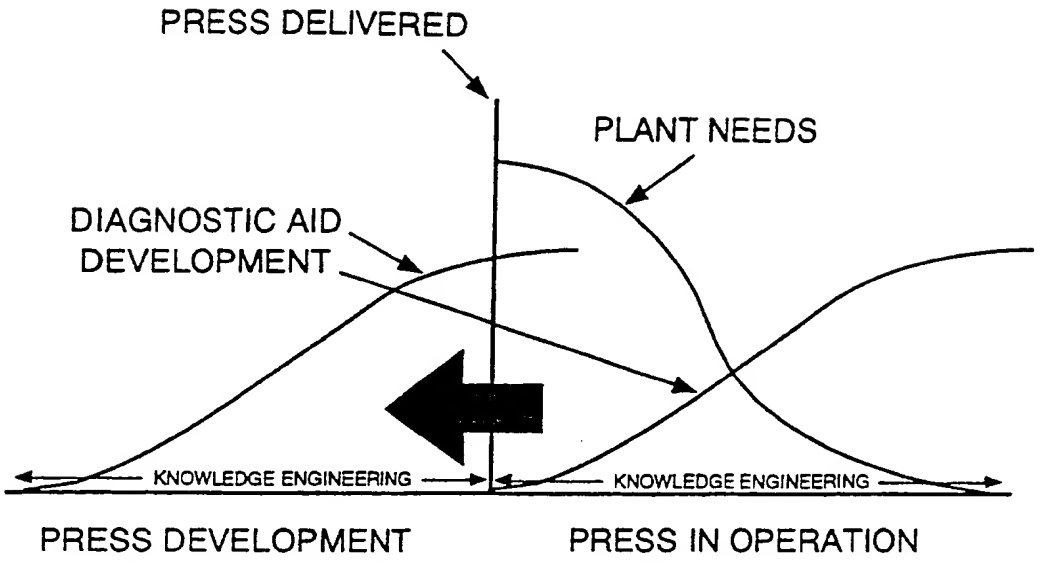
PRESS DELIVERED
PLANT NEEDS
DIAGNOSTIC AID
DEVELOPMENT
KNOWLEDGE ENGINEERING
KNOWLEDGE ENGINEERING
PRESS DEVELOPMENT
PRESS IN OPERATION

Fig. 1

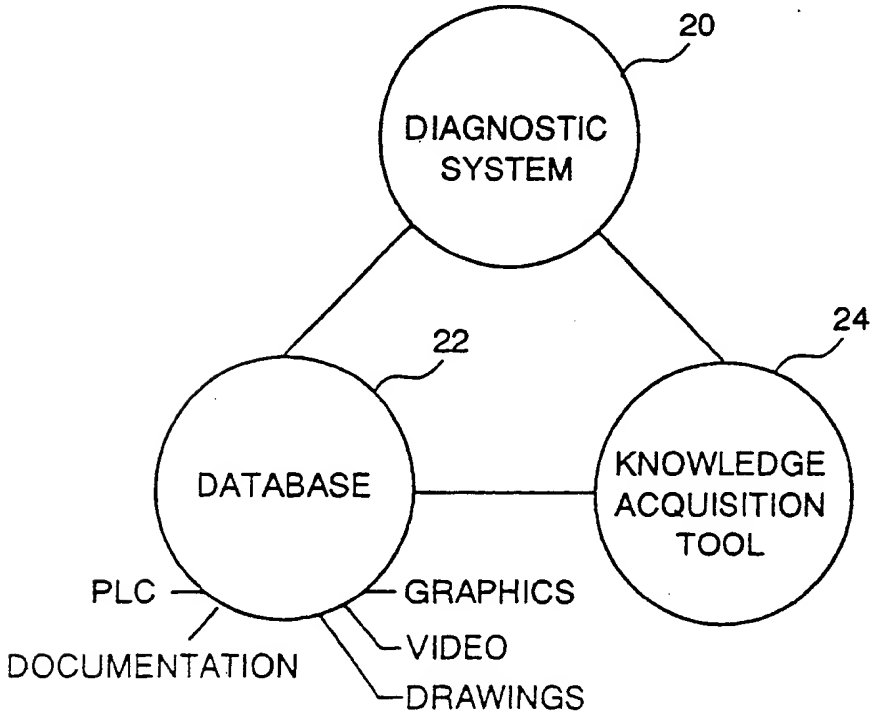
20
DIAGNOSTIC SYSTEM
22
24
DATABASE
KNOWLEDGE ACQUISITION TOOL
PLC
DOCUMENTATION
GRAPHICS
VIDEO
DRAWINGS

Fig. 2

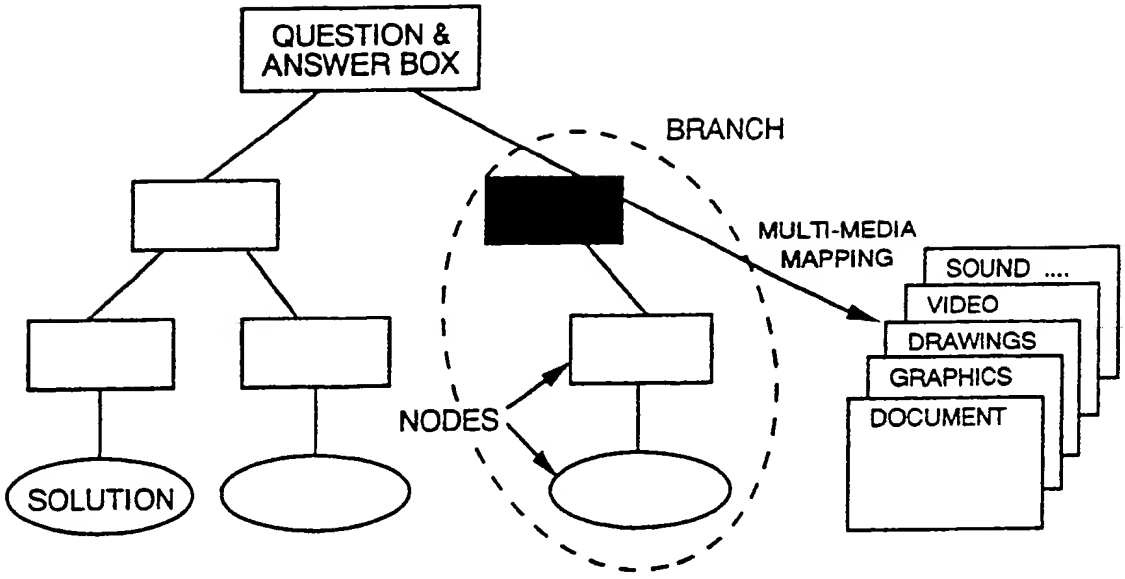
QUESTION & ANSWER BOX
BRANCH
MULTI-MEDIA MAPPING
SOUND ....
VIDEO
DRAWINGS
GRAPHICS
DOCUMENT
NODES
SOLUTION

Fig. 3

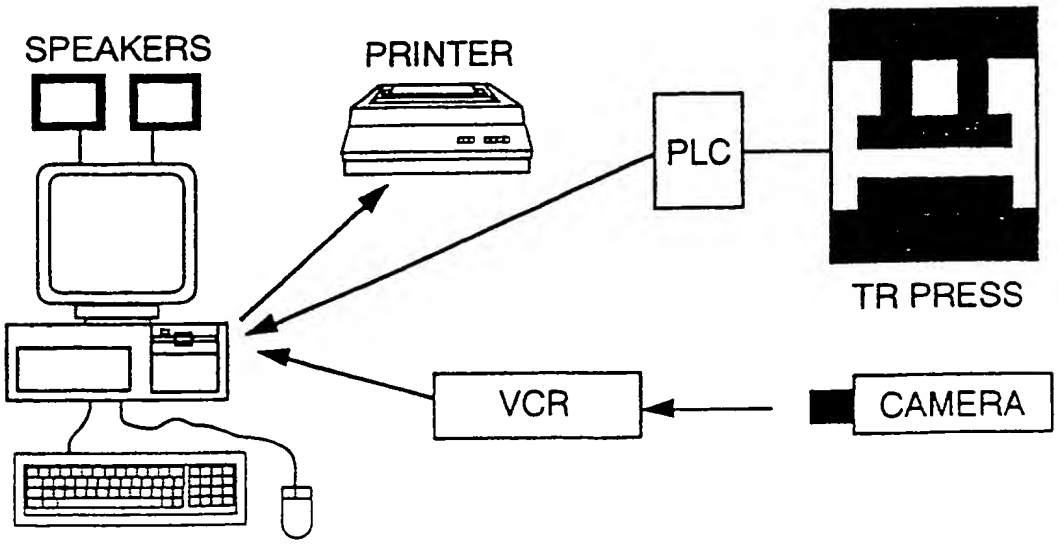
SPEAKERS
PRINTER
PLC
TR PRESS
VCR
CAMERA

Fig. 4

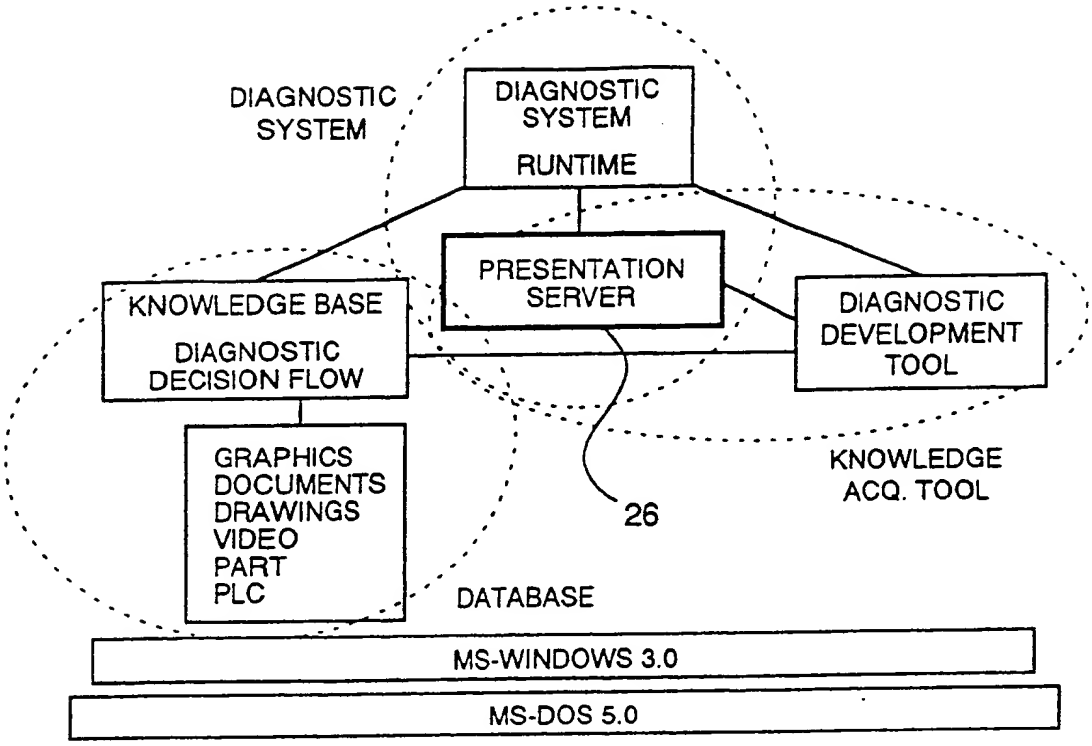
DIAGNOSTIC SYSTEM
DIAGNOSTIC SYSTEM RUNTIME
PRESENTATION SERVER
KNOWLEDGE BASE
DIAGNOSTIC DECISION FLOW
DIAGNOSTIC DEVELOPMENT TOOL
GRAPHICS
DOCUMENTS
DRAWINGS
VIDEO
PART
PLC
26
KNOWLEDGE ACQ. TOOL
DATABASE
MS-WINDOWS 3.0
MS-DOS 5.0

Fig. 5

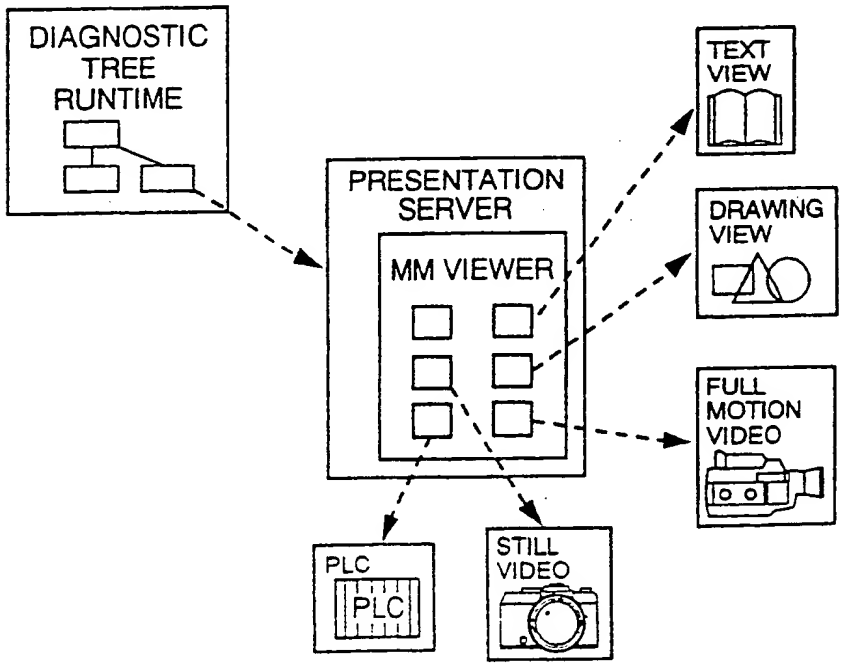
DIAGNOSTIC TREE RUNTIME
PRESENTATION SERVER
MM VIEWER
TEXT VIEW
DRAWING VIEW
FULL MOTION VIDEO
STILL VIDEO
PLC
PLC

Fig. 6

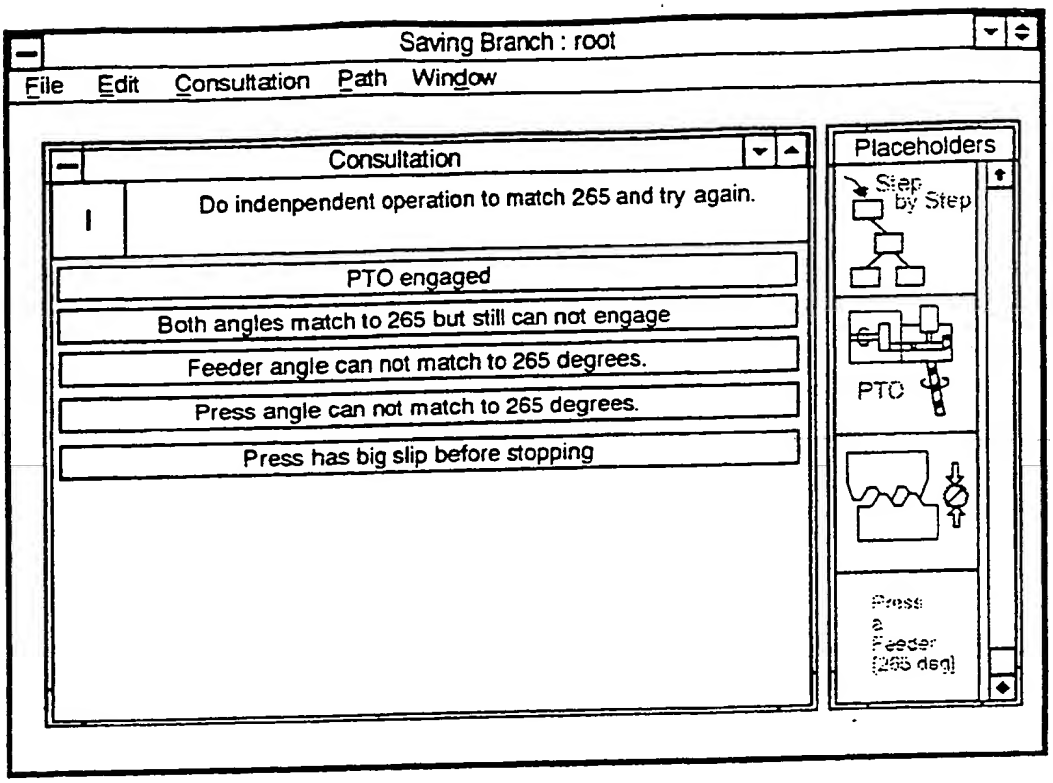
Saving Branch : root
File Edit Consultation Path Window
Consultation
Do indenpendent operation to match 265 and try again.
PTO engaged
Both angles match to 265 but still can not engage
Feeder angle can not match to 265 degrees.
Press angle can not match to 265 degrees.
Press has big slip before stopping
Placeholders
Step by Step
PTO

Fig. 7

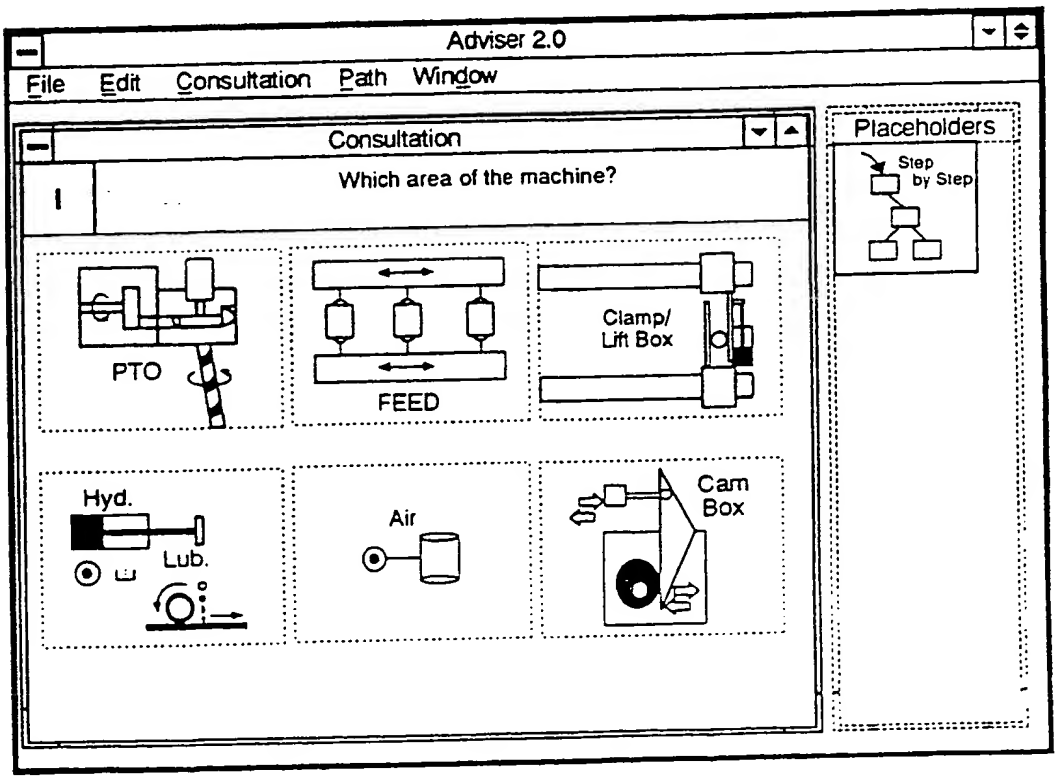
Adviser 2.0
File Edit Consultation Path Window
Consultation
Which area of the machine?
PTO
FEED
Clamp/ Lift Box
Hyd.
Lub.
Air
Cam Box
Placeholders
Step by Step

Fig. 8

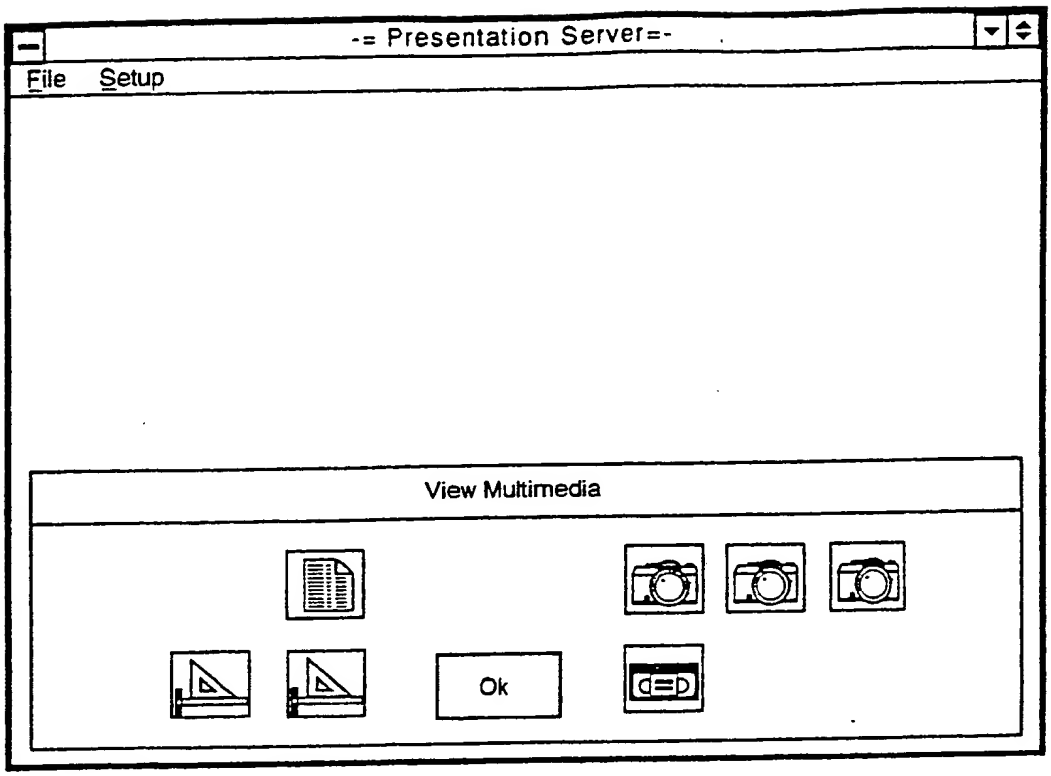
-= Presentation Server=-
File Setup
View Multimedia
Ok

Fig. 9

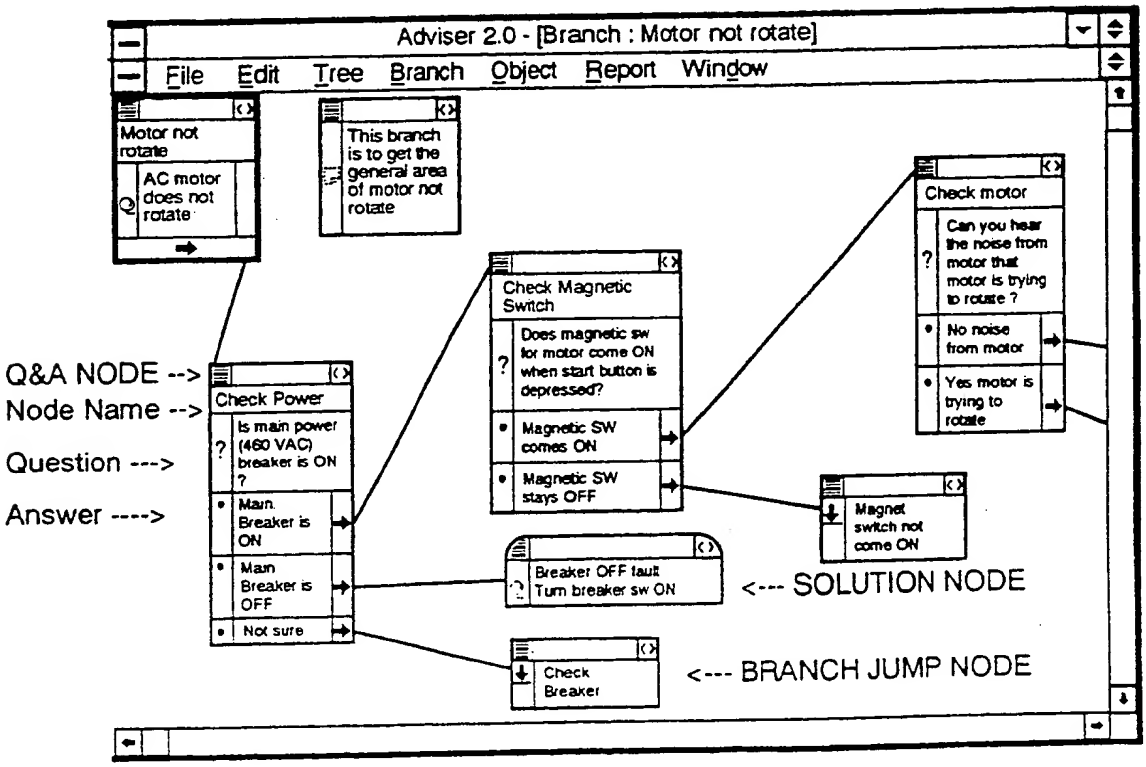
Adviser 2.0 - [Branch : Motor not rotate]
File Edit Tree Branch Object Report Window
Motor not rotate
AC motor does not rotate
This branch is to get the general area of motor not rotate
Check Power
Is main power (460 VAC) breaker is ON ?
Main Breaker is ON
Main Breaker is OFF
Not sure
Check Magnetic Switch
Does magnetic sw for motor come ON when start button is depressed?
Magnetic SW comes ON
Magnetic SW stays OFF
Check motor
Can you hear the noise from motor that motor is trying to rotate ?
No noise from motor
Yes motor is trying to rotate
Magnet switch not come ON
Breaker OFF fault Turn breaker sw ON
Check Breaker
Q&A NODE -->
Node Name -->
Question --->
Answer ---->
<--- SOLUTION NODE
<--- BRANCH JUMP NODE

Fig. 10

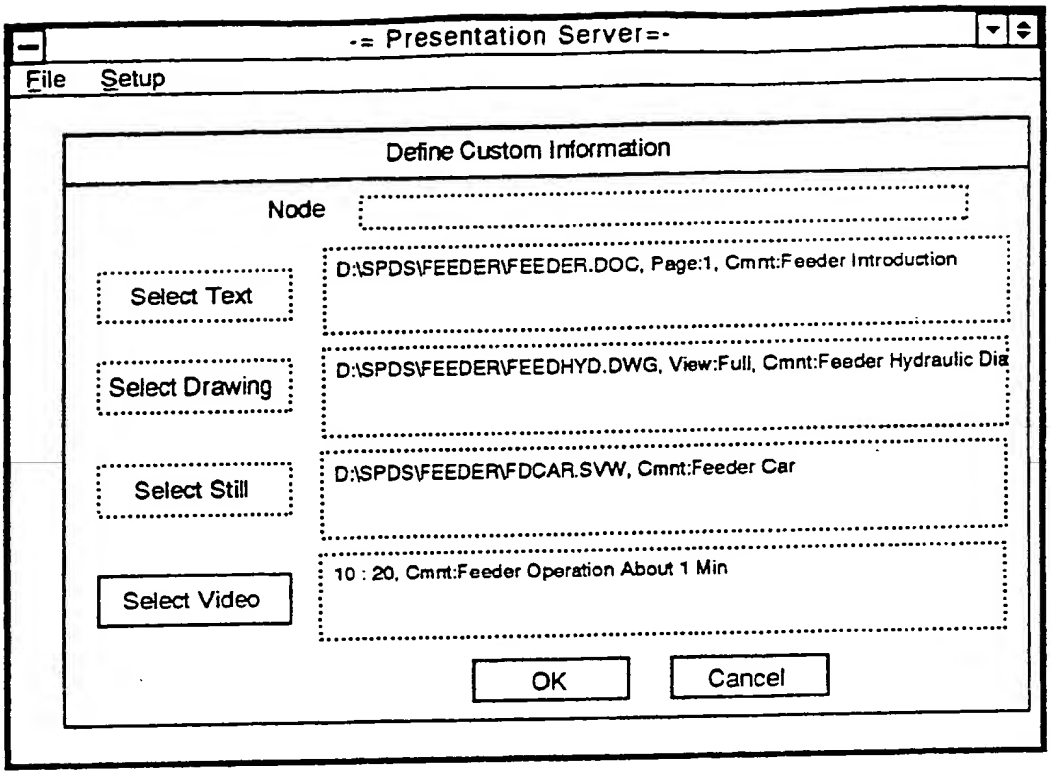
-= Presentation Server=-
File
Setup
Define Custom Information
Node
Select Text
D:\SPDS\FEEDER\FEEDER.DOC, Page:1, Cmnt:Feeder Introduction
Select Drawing
D:\SPDS\FEEDER\FEEDHYD.DWG, View:Full, Cmnt:Feeder Hydraulic Dia
Select Still
D:\SPDS\FEEDER\FDCAR.SVW, Cmnt:Feeder Car
Select Video
10 : 20, Cmnt:Feeder Operation About 1 Min
OK
Cancel

Fig. 11

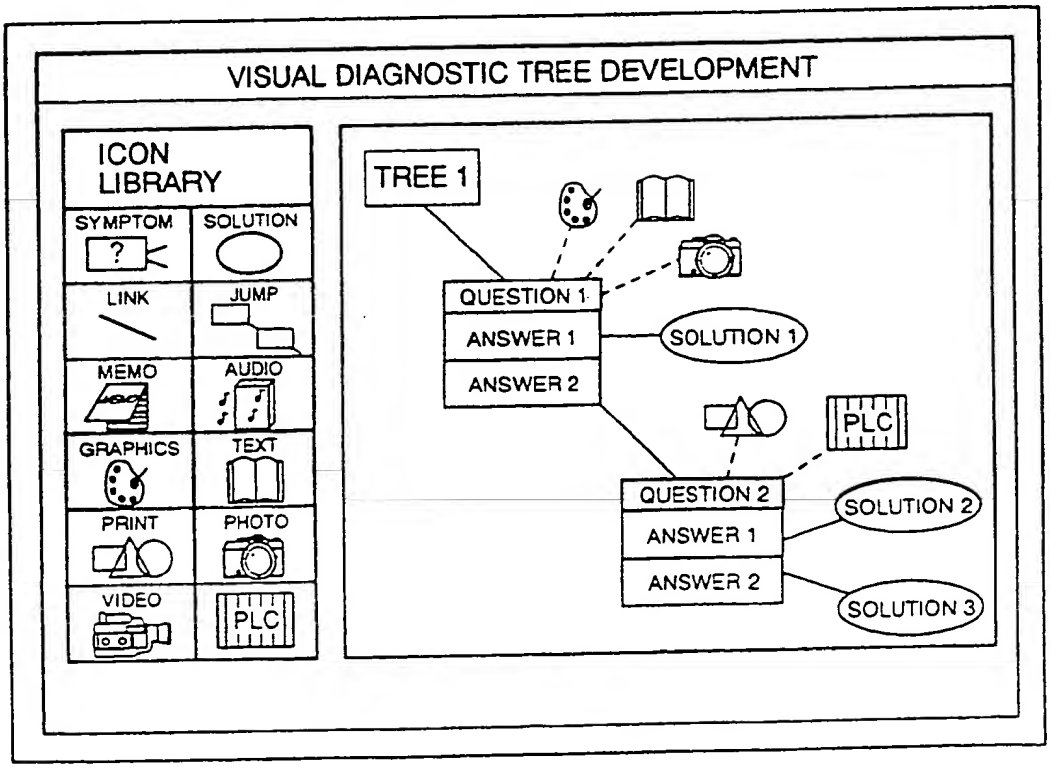
VISUAL DIAGNOSTIC TREE DEVELOPMENT
ICON LIBRARY
SYMPTOM
SOLUTION
LINK
JUMP
MEMO
AUDIO
GRAPHICS
TEXT
PRINT
PHOTO
VIDEO
PLC
TREE 1
QUESTION 1
ANSWER 1
ANSWER 2
SOLUTION 1
PLC
QUESTION 2
ANSWER 1
ANSWER 2
SOLUTION 2
SOLUTION 3

Fig. 12

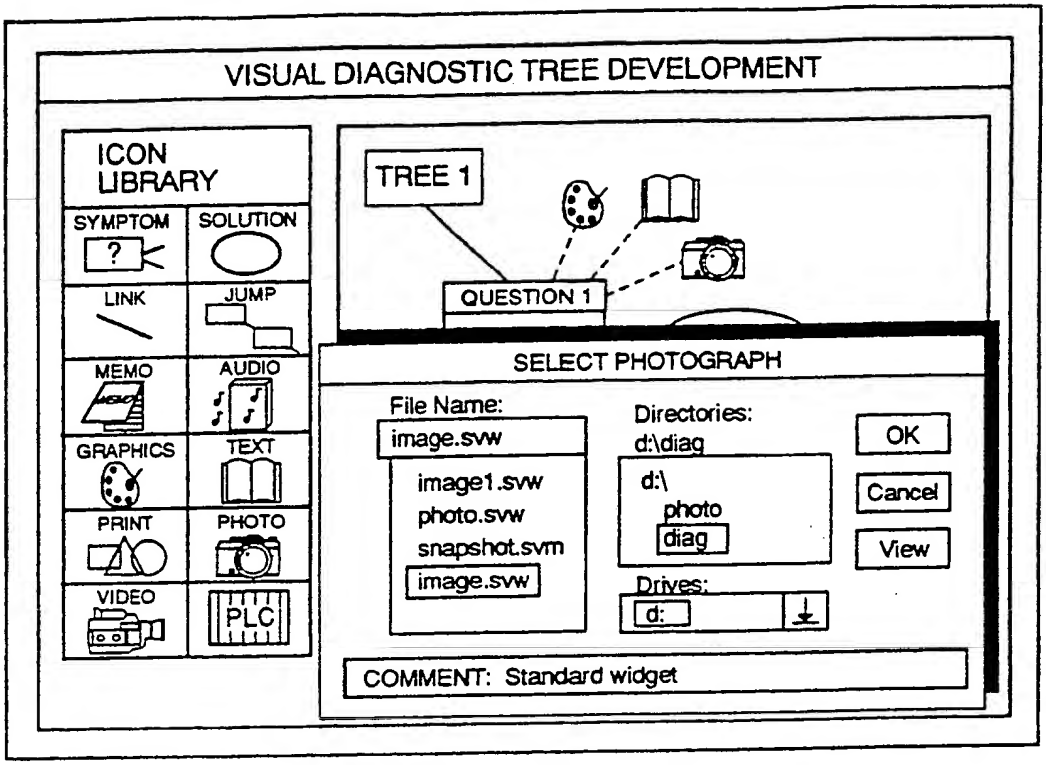
VISUAL DIAGNOSTIC TREE DEVELOPMENT
ICON LIBRARY
SYMPTOM
SOLUTION
LINK
JUMP
MEMO
AUDIO
GRAPHICS
TEXT
PRINT
PHOTO
VIDEO
PLC
TREE 1
QUESTION 1
SELECT PHOTOGRAPH
File Name:
image.svw
image1.svw
photo.svw
snapshot.svm
image.svw
Directories:
d:\diag
d:\
photo
diag
Drives:
d:
OK
Cancel
View
COMMENT: Standard widget

Fig. 13

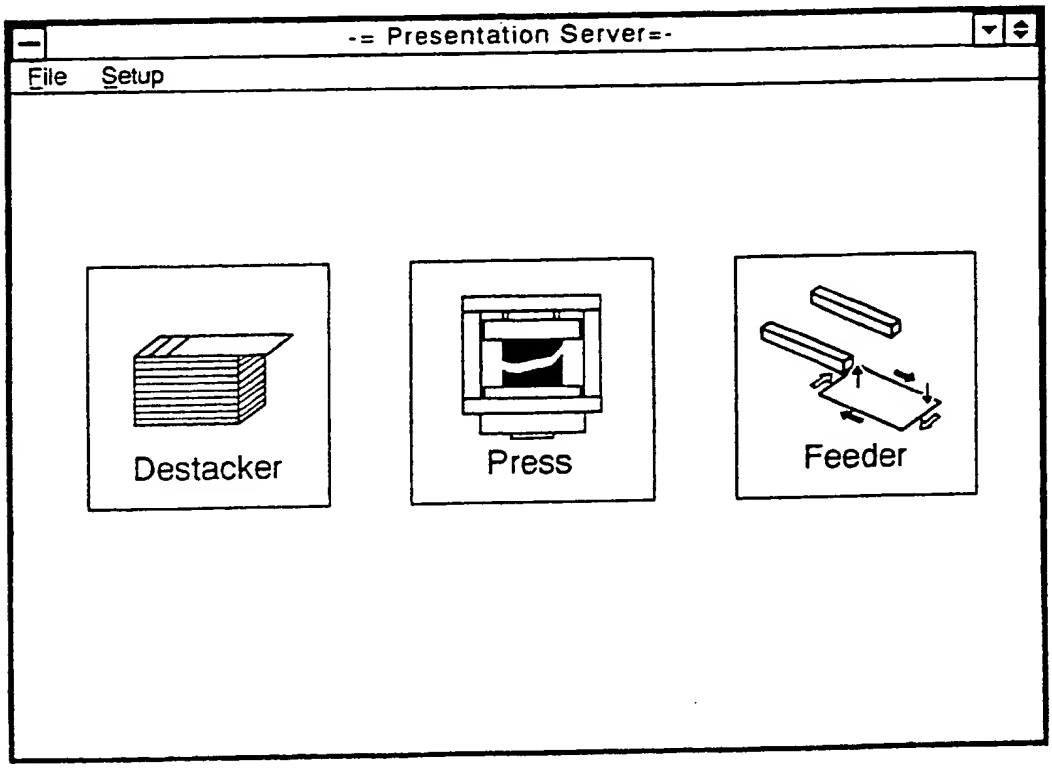
-= Presentation Server=-
File
Setup
Destacker
Press
Feeder

Fig. 14

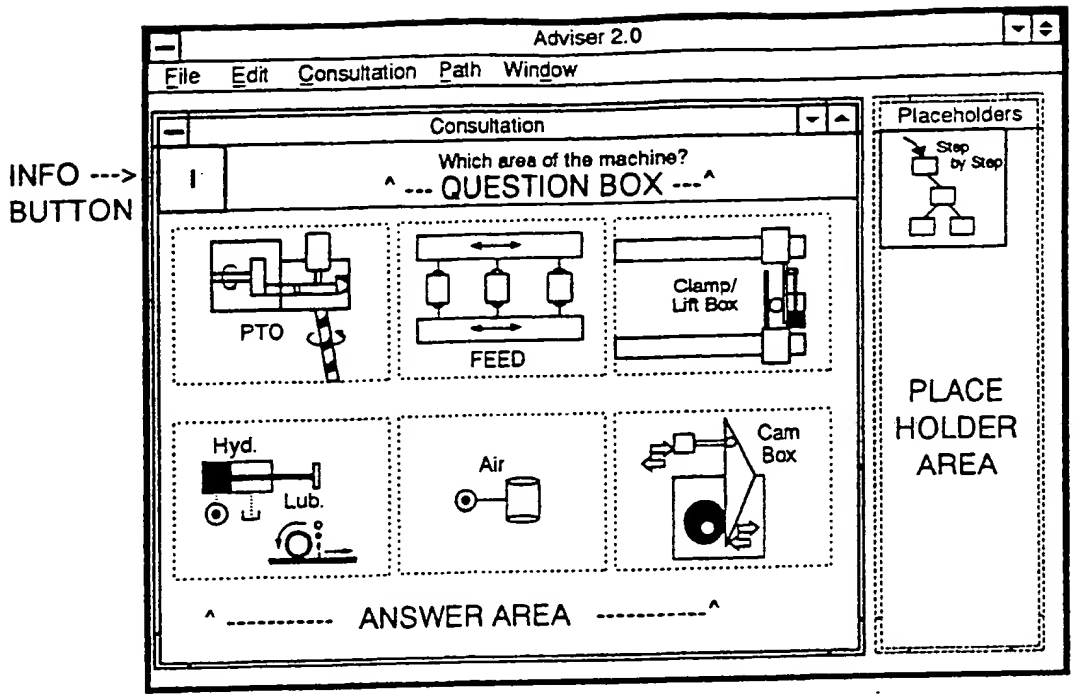
Adviser 2.0
File Edit Consultation Path Window
Consultation
Which area of the machine?
^ --- QUESTION BOX ---^
INFO ---> BUTTON
PTO
FEED
Clamp/ Lift Box
Hyd.
Lub.
Air
Cam Box
^ ---------- ANSWER AREA ----------^
Placeholders
Step by Step
PLACE HOLDER AREA

Fig. 15

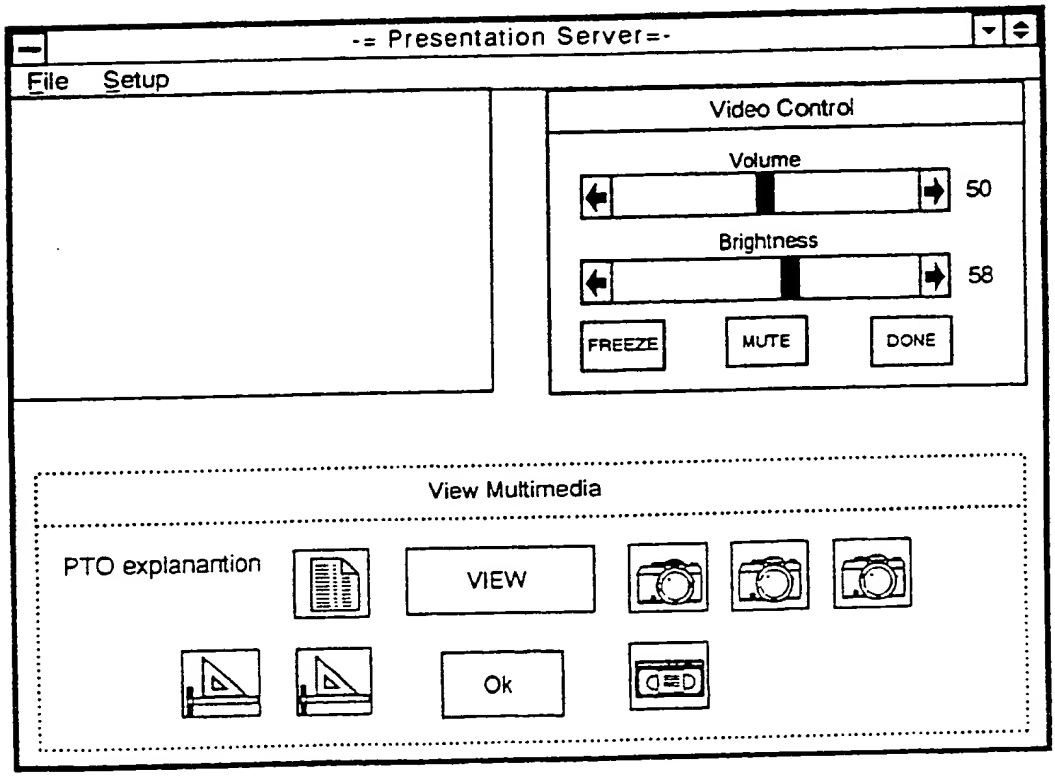
-= Presentation Server=-
File Setup
Video Control
Volume
50
Brightness
58
FREEZE
MUTE
DONE
View Multimedia
PTO explanantion
VIEW
Ok

Fig. 16

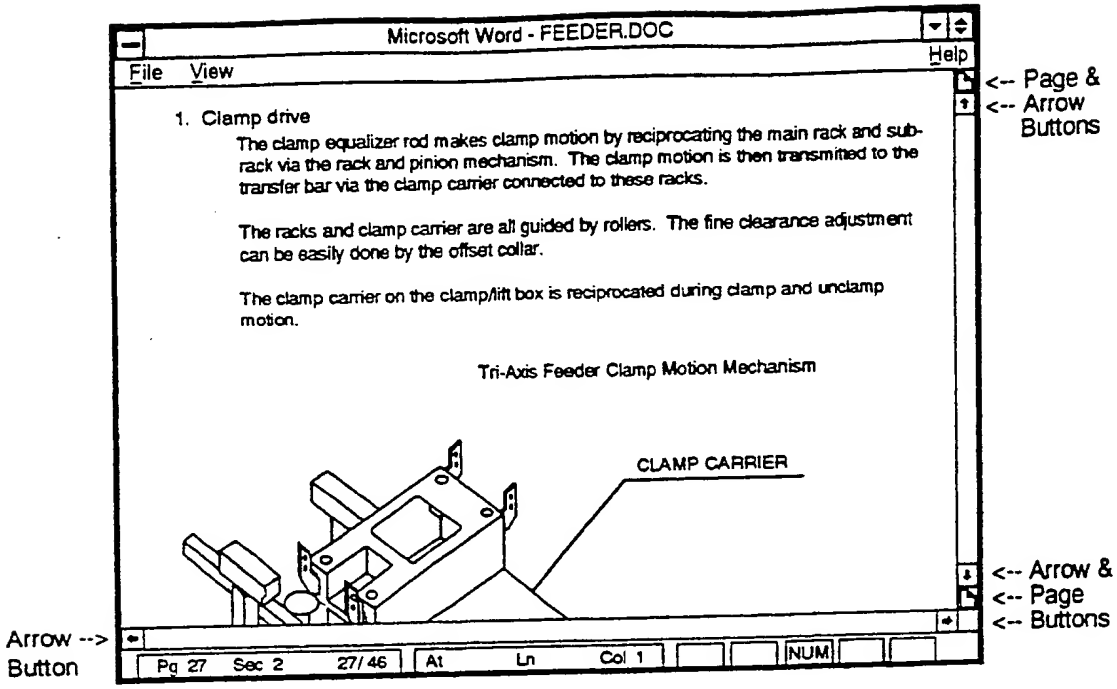
Microsoft Word - FEEDER.DOC
File View
Help
1. Clamp drive
The clamp equalizer rod makes clamp motion by reciprocating the main rack and sub-rack via the rack and pinion mechanism. The clamp motion is then transmitted to the transfer bar via the clamp carrier connected to these racks.
The racks and clamp carrier are all guided by rollers. The fine clearance adjustment can be easily done by the offset collar.
The clamp carrier on the clamp/lift box is reciprocated during clamp and unclamp motion.
Tri-Axis Feeder Clamp Motion Mechanism
CLAMP CARRIER
Pg 27 Sec 2 27/46 At Ln Col 1 NUM
<-- Page & <-- Arrow Buttons
<-- Arrow & <-- Page <-- Buttons
Arrow --> Button

Fig. 17

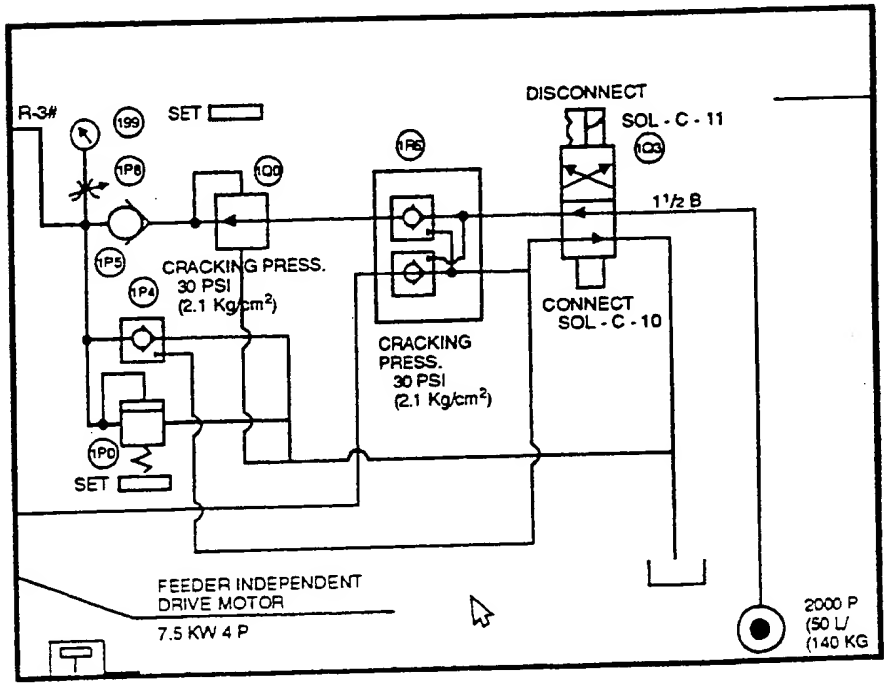
R-3#
199
SET
1P8
1Q0
1P5
1P4
CRACKING PRESS.
30 PSI
(2.1 Kg/cm²)
1P0
SET
1R6
CRACKING
PRESS.
30 PSI
(2.1 Kg/cm²)
DISCONNECT
SOL - C - 11
1Q3
1½ B
CONNECT
SOL - C - 10
FEEDER INDEPENDENT
DRIVE MOTOR
7.5 KW 4 P
2000 P
(50 L/
(140 KG

Fig. 18

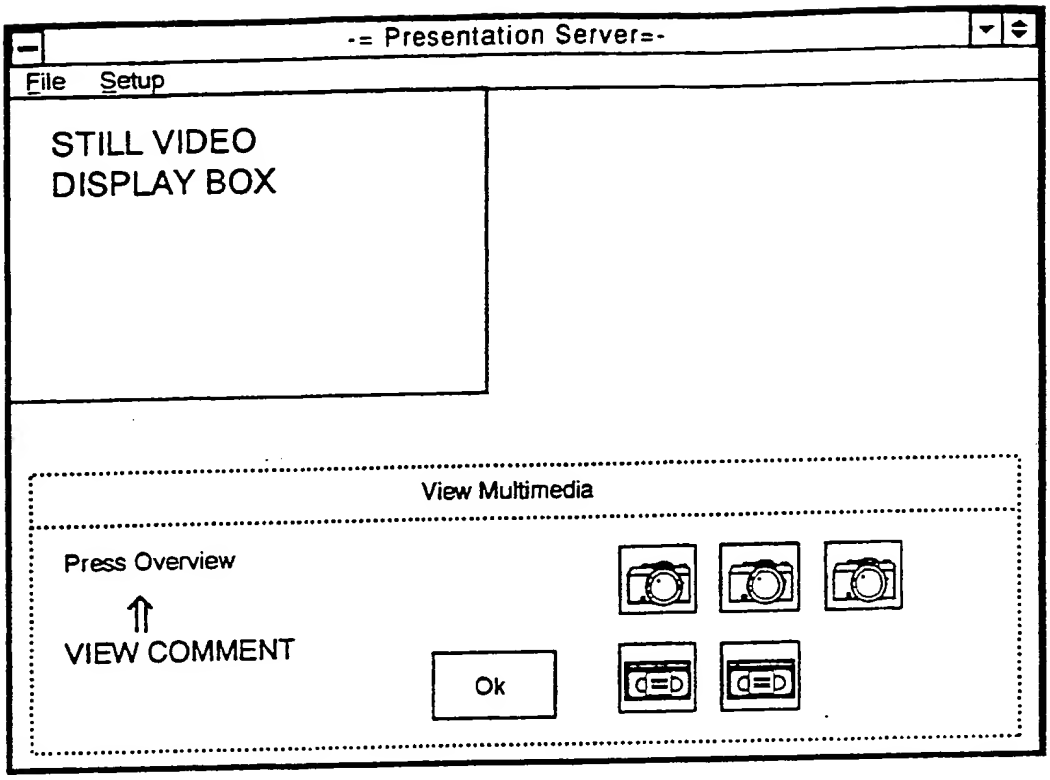
-= Presentation Server=-
File Setup
STILL VIDEO
DISPLAY BOX
View Multimedia
Press Overview
VIEW COMMENT
Ok

Fig. 19

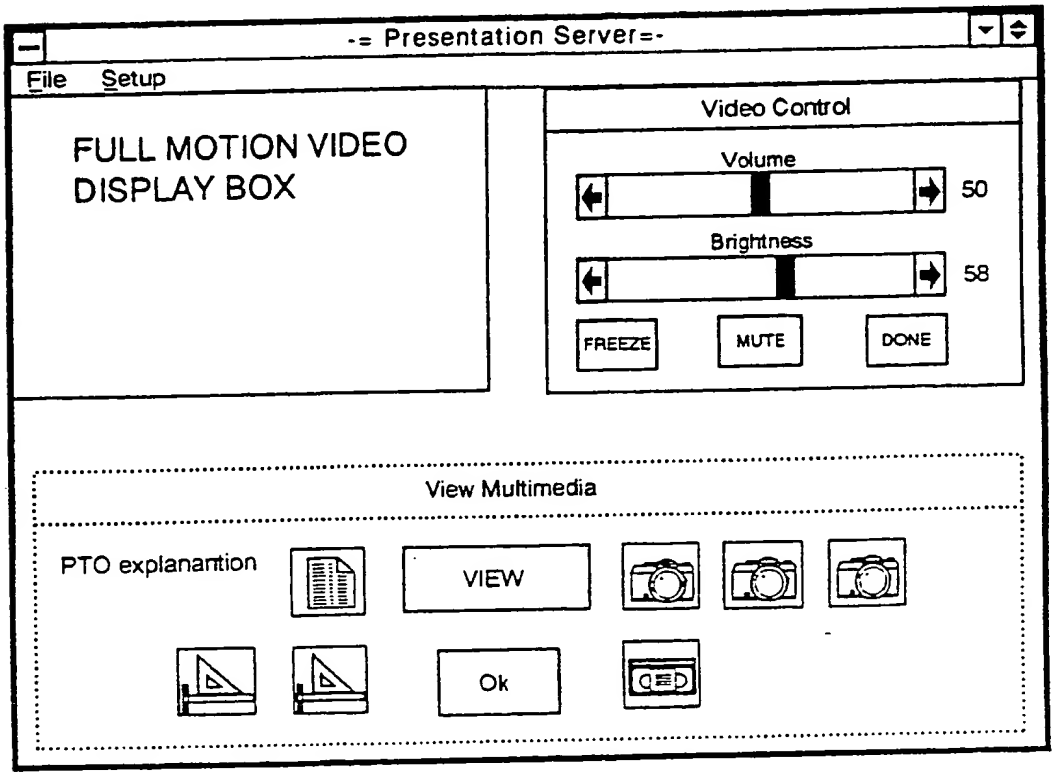
-= Presentation Server=-
File Setup
FULL MOTION VIDEO
DISPLAY BOX
Video Control
Volume
50
Brightness
58
FREEZE
MUTE
DONE
View Multimedia
PTO explanantion
VIEW
Ok

Fig. 20

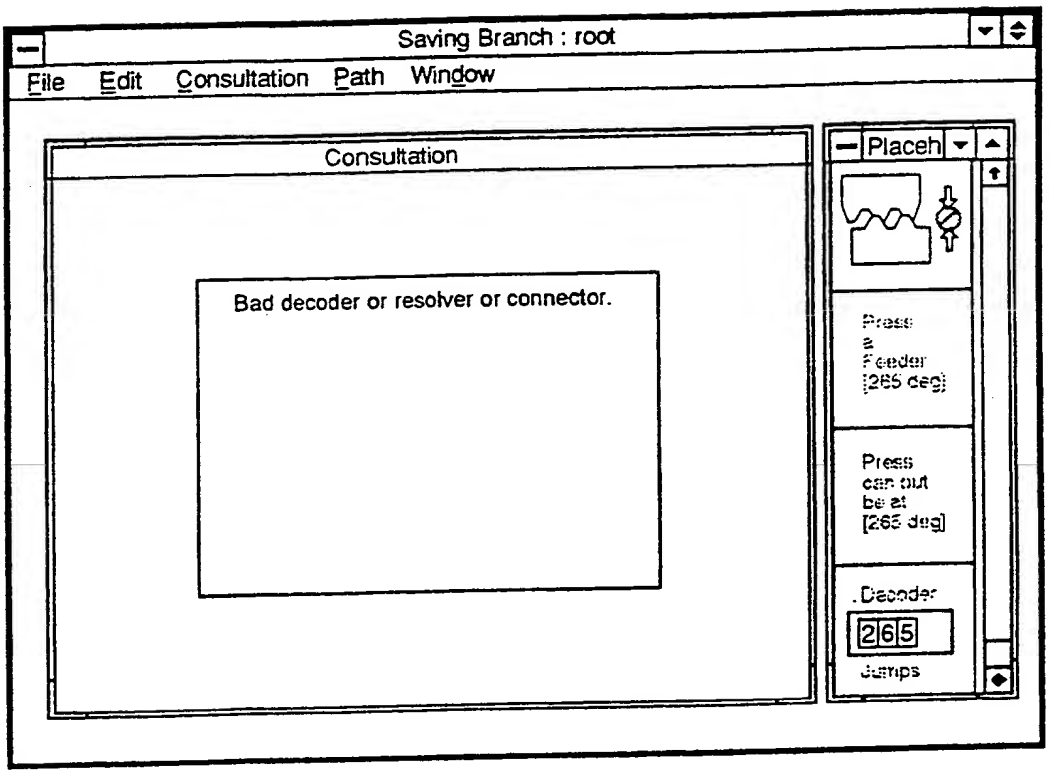
Saving Branch : root
File Edit Consultation Path Window
Consultation
Bad decoder or resolver or connector.
Placeh
Press
a
Feeder
[265 deg]
Press
can out
be at
[265 deg]
Decoder
265
Jumps

Fig. 21

2271005

METHOD AND SYSTEM FOR PROCESSING AND PRESENTING ON-LINE, MULTIMEDIA INFORMATION IN A TREE STRUCTURE

This invention relates to methods and systems for processing and presenting multimedia information and, in particular, to methods and systems for processing and presenting on-line, multimedia information such as diagnostic information for a machine tool in a tree structure.

Reference is made to an application entitled "Method And System For Diagnosing Machines" filed on the same day as this application, having the same assignee, and which is hereby expressly incorporated in its entirety by reference.

There exists a need for timely delivery of diagnostic information for machine tools such as stamping presses. As illustrated in Figure 1, the need is the greatest when the press is first delivered. As time passes, the plant personnel become more experienced and less dependent on a diagnostic system. The key is continually to have the proper tools present to minimize press down time, regardless of the need.

Based on these observations, the machine tool manufacturer must develop the diagnostic aid as the press is being designed if this goal is going to be achieved.

Current expert systems and/or artificial intelligence technology tools can not meet the above direction, goals and design needs. The deficiency is in the ability to allow end users to build and maintain diagnostics, especially as the plant machinery goes through modification. Based on the current state of software/hardware technology (i.e. object oriented), there exists a need for a new method and system which uses this technology in a novel way for capturing, preserving and delivering machine tool diagnostic and support information.

The U.S. patent to Isle et al. (4,931,950) discloses a multimedia interface method for a knowledge-based diagnostic system. The knowledge-based system stores multimedia

commands to control multimedia outputs for presenting information to users.

The U.S. patent to Tsumura (4,954,969) discloses a system for processing multimedia information in a easily usable form.

The U.S. patent to Singh (4,954,964) discloses an apparatus and method for expert analysis of metal failure with automated visual aid. The invention combines an expert system with a video or photographic display system.

The U.S. patent to Rutherfoord et al. (4,893,256) discloses an interactive multimedia presentation system and a method for developing the presentation.

The U.S. patent to Bodick et al. (4,945,476) discloses a knowledge-base system with stored pictorial images for use in medical diagnostic environments.

The prior art discloses the use of icons in various systems. For example, the U.S. patent to Nose et al. (5,025,395) discloses a data processing system which employs icons to represent various functions of the system.

The U.S. patent to Wexelblat et al. (5,021,976) discloses a method and system for generating dynamic, interactive visual representations of information structures. The patent teaches the use of iconic representations in an information system.

The U.S. patents to Dunn (4,656,603 and 4,813,013) disclose interactive rule based systems employing icons. The system generates and stores a specific set of rules pertaining to the use of each icon.

The paper entitled "The Relationship Between Multimedia And Expert Systems" by John Coyne, discloses a philosophy to using an expert system and multimedia but fails to provide many details.

The U.S. patent to Franke et al. (4,710,763) discloses a method of constructing and developing a tree structure. An operator is capable of performing editing and evaluating functions on the tree.

The U.S. patent to Watson et al. (4,902,469) discloses apparatus for producing a discrete state display including

status trees and status tree node operations.

An object of the present invention is to provide a method and system for processing and presenting on-line, multimedia information in a tree structure.

Another object of the present invention is to provide a relatively simple and flexible method and system for processing and presenting on-line, multimedia information such as diagnostic information for a machine tool wherein initial diagnostic knowledge and documentation (such as drawings) are electronically captured as designers are designing the machine tool, which eliminates any possible loss or re-engineering of this information at a later time.

According to the present invention there is provided a method for processing and presenting multimedia information in a tree structure including branches having a plurality of nodes and node-connecting links in a computer system having tree display means for displaying nodes of the tree structure, the method comprising the steps of:

providing command display means for displaying multimedia commands representative of various types of multimedia information;

providing multimedia output means for providing multimedia information to a user of the system;

providing a knowledge base for storing a multiplicity of information records mapped into the tree structure, the information records including:

means for denoting the text strings that can be displayed on the tree display means;

means for denoting the multimedia commands that can be displayed on the command display means; and

means for denoting the multimedia information that can be presented by said multimedia output means;

receiving an initial command;

displaying at least one selected node of the tree structure including at least one text string on the tree display means in response to the initial command;

displaying a plurality of multimedia commands corresponding to the at least one selected node on the

command display means;

receiving a user command related to one of the displayed multimedia commands; and

delivering a selected amount of the multimedia information to the multimedia output means to be presented thereby to the user of the system in response to the user command.

A system is also provided for carrying out each of the above method steps.

Preferably, the multimedia commands are displayed on the command display in the form of graphic icons.

The invention will now be described further by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a graph illustrating the interrelationship of the need for diagnostic information to press development time and press operational time;

Figure 2 is a schematic diagram illustrating the architecture of the system of the present invention including a diagnostic system coupled to a database of machine-specific knowledge and support information;

Figure 3 is a schematic diagram of a diagnostic tree and multimedia mapping of the present invention;

Figure 4 is a schematic view of the hardware of the system;

Figure 5 is a schematic view of the software of the system;

Figure 6 is a schematic block diagram of a diagnostic tree and presentation server structure of the present invention;

Figure 7 is a schematic view of an example question and answer (Q and A) screen in text format;

Figure 8 is a schematic view of an example question and answer screen in graphics-with-text format;

Figure 9 is a schematic view of a presentation server screen;

Figure 10 is a schematic view of a diagnostic branch (edit) screen;

Figure 11 is a graphical view of a presentation server edit screen or multimedia definition screen;

Figure 12 is a graphical view of a screen illustrating diagnostic tree development with multimedia icon edit;

Figure 13 is a graphical view of a media selection server;

Figure 14 is a graphical view of an initial application screen;

Figure 15 is a graphical view of a standard Q and A screen similar to Figure 8;

Figure 16 is a graphical view of a multimedia view screen similar to Figure 9 with video selected;

Figure 17 is a graphical view of a documentation view screen;

Figure 18 is a graphical view of a screen for a drawing;

Figure 19 is a graphical view of a screen for still video;

Figure 20 is a graphical view of a screen for full motion values; and

Figure 21 is a graphical view of a solution screen.

Referring now to the drawing figures, there is schematically illustrated in Figure 2 a system including a generic core of software and hardware, which is referred to below as a diagnostic system 20 for use with a machine tool such as a press. To give life to the diagnostic system 20 for a unique machine tool diagnostic solution requires specific machine tool diagnostic knowledge and support information (referred to below as a database 22).

The architecture of the system illustrated in Figure 2, shows three primary components of the system: the diagnostic system 20, a knowledge acquisition tool 24, and the database 22.

The diagnostic system 20 is dependent on the data to enable it as an application. The data in the database 22 includes machine tool specific diagnostic knowledge and support information (i.e. drawings and video) which is stored in the form of information records. The machine tool

support information provides alternative methods of communication and documentation necessary to properly inform the end user while doing his or her job. Another important aspect of this architecture is that the machine specific support information can be stored in its original format (for example, Wordperfect). There is no need to translate or re-engineer the information, thus reducing development time, expense and effort.

The knowledge acquisition tool 24 of the present invention is relatively simple and intuitive to use; provides graphical representation of diagnostics knowledge; and provides mapping of machine tool related support information.

The tool 24 represents the knowledge in graphical trees (or diagnostic trees). Within a tree there are several questions and answers, and solution nodes as illustrated in Figure 3. Nodes can be grouped together into branches, making the diagnostic tree more modular and reusable. There is no software programming involved in building the trees or mapping the support knowledge - it is performed through graphical visual programming. Training to use of the diagnostic tool can be accomplished relatively quickly.

The procedure is similar to using a computer drawing package, by graphically selecting and placing objects (denoted by boxes), asserting text (questions & answers), linking boxes and assigning support information to respective nodes as illustrated in Figure 3. Training to build and maintain diagnostic trees, and assign or edit machine specific support information can also be accomplished relatively quickly.

The method and system of the present invention preferably utilizes an IBM PC platform that operates under DOS 5.0 and Windows 3.0. This platform provides a rich design environment and option flexibility.

The target system preferably includes, at a minimum, an IBM (RTM) 386/486 or compatible computer with a 200Mb hard drive, 8 Mb of RAM, VGA display, Video card, a computer controlled VCR, optional speakers, and a direct connection to a press

PLC network as illustrated in Figure 4.

There is illustrated in Figure 5, a software portion of the system. The software includes commercially available software and one custom piece of software called a presentation server 26. The Windows 3.0 environment allows multiple software package to run concurrently and communicate between themselves. Communication between the software packages leverages the software packages functionality into a integrated solution and minimizes software development.

The diagnostic system 20, the knowledge acquisition tool 24 and the database 22 are preferably incorporated in a software package called "Advisor" provided by Emerald Intelligence of Ann Arbor, Michigan. Advisor provides the environment to build and execute diagnostics. To assign (i.e. map) and present (i.e. display) multimedia information for each of the diagnostic tree nodes as illustrated in Figure 6, Advisor communicates and interacts with the presentation server 26. The presentation server 26 then communicates with the media specific software packages (i.e. Microsoft Word (RTM) for documentation media) to select and view.

With this architecture, it is possible for each diagnostic node to have multimedia information assigned or mapped thereto thus improving the communication between the operator and the computer. The standard forms of multimedia utilized are: drawings, documentations, graphics, photographs, full motion video and audio, animation, sound, etc. For example, this approach can provide a better and easier means of on-line interactive repair and training procedures (i.e. by using full motion video) to the operator when a cause of the problem is determined. Also, because the architecture allows for the multimedia information to be used in its original format, there is no need to re-engineer the media information for it to be deliverable.

Based on this software architecture, there are two system utilities: the runtime solution or utility referred to as RUNTIME and the diagnostic tree building solution or utility referred to as BUILDER, as also described

hereinbelow.

RUNTIME

Within the RUNTIME software there are two forms of executing the diagnostics: PLC directed or operator step-by-step operation. The PLC directed approach involves the computer receiving a predefined PLC fault code relative to a press malfunction. Once the PLC fault is recognized, the software jumps to a specific assigned location in the diagnostic tree (the same diagnostic process can be completed using the operator step-by-step approach, discussed below). The benefit of this approach is to minimize operator-to-computer diagnostic dialogue and get to the cause of the problem as quickly as possible. The key limitation of this approach is that it only applies to sensory faults. Non-sensory faults will need to be diagnosed in the step-by-step approach.

In either of the approaches (PLC directed or step-by-step), the operator is asked a series of questions until he reaches the cause of the press problem. In the step-by-step approach, the diagnostics always starts from the top of the tree. Answers for questions are presented in one of two formats: text or graphics with text. The text type answer is a traditional format illustrated in Figure 7, and is the easiest to generate and least time-consuming. The graphics with text, as illustrated in Figure 8, is a format that conveys the message faster and with less effort for the operator, but does take more development time because of the graphic development. Both of the answer formats can be intermixed in the diagnostics, but are defined and fixed in the diagnostic at the time of tree development.

Another important feature in both the Question & Answer formats is the placeholders. The placeholder reminds the operator of the path that has been chosen and allows the operator to "Back Up" to a previous diagnostic screen.

Also, at any time during the diagnostic session, if related machine specific support information has been

assigned to a particular question & answer or solution screen, an "i" button is displayed in the upper left hand corner as illustrated in Figures 7 and 8. By selecting the "i" button, the presentation server 26 is activated as illustrated in Figure 9, which allows the operator to view the different assigned media relative to that node function in the form of multimedia commands. More detail on the use of the runtime solution is described hereinbelow.

BUILDER

BUILDER allows one to define and/or maintain machine diagnostic trees (a graphical representation of a diagnostic decision step or flow) and assign multimedia machine information to the respective tree node.

To briefly demonstrate the ease and simplicity of creating a diagnostic tree, reference may be made to Figure 10. Diagnostic trees are made up of branches. Branches are made up of four primary components:

* Question & Answer (Q&A) nodes
* Solutions nodes
* Branch jump nodes
* links or lines.

The Q&A node states a question with an unlimited number of answers. The solution node states the cause of the problem and needed repair for the cause of the problem. To assign a Q&A node (or solution node), a point mark is first located on the screen (click mouse) where one would like to place the node. Second, the type of node is selected from the above screen menu select: OBJECT-CREATE-SYMPTOM for Q&A node, or OBJECT-CREATE-SOLUTION for a solution node. This procedure places the object node on the screen as previously marked. To fill in the node name, the Q&A, or solution text information, the node is selected with the mouse pointer and the text is entered. Graphical answers with text can alternatively be used to replace the standard textual answers. To add more answers to a Q&A node, the node is selected and then OBJECT-ADD VALUE/TEST is selected from the

menu screen. To link an answer to the next question or solution, a right arrow icon is selected in the preferred answer box then the mouse pointer is dragged to the respective question, branch or solution and the mouse button is released. This places a link or line between the two object nodes.

The above steps are repeated until the desired tree is built. Objects within a screen can freely be moved around, primarily for appearance and readability, without effecting the linking. Anytime while editing a tree, one can run the diagnostics by selecting from the screen menu, FILE-RUN TEST. This will bring one into the RUNTIME (test mode) with the current tree information.

To define machine specific multimedia information for any of the Q&A and solution nodes, one needs to access the presentation server screen. First, one double click on "?" in the Q&A box or just on the solution box. This brings up the question or solution editor screen and then one enters CTRL and -> keys, which brings up the presentation server (screen illustrated in Figure 11). The keys do this by executing a recorded Windows 3.0 macro. To assign the desired media (documentation, drawing, photograph or video), the button on the left is selected. A file directory box (not shown) pops up to allow one to look up the hard disk for the desired file. Once the file is selected, there is an opportunity to preview the material, define required additional information (i.e. page number within a documentation) and assign comment information before mapping. When the media is selected, it is listed in the appropriate media box as illustrated in Figure 11. There are, preferably, five different choices of material for each of the forms of media. When all the media is assigned, OK is entered to return to the builder screen.

Building Diagnostic Trees And
Assigning Multimedia Information

Using Graphic Icons

The process here is similar to the above BUILDER process but is simpler to generate trees and assign multimedia information. There is also the use of more graphic icons (i.e. see the solution block of Figure 12) instead of menu selections.

STEP 1:

To an assign symptom block (Q&A block) or solution block, an icon on the left in Figure 12 is first selected, and located on the right side or work area of Figure 12. To fill in the Q&A or solution block text information name, the block field with the mouse pointer is selected and the text is entered. To link an answer to the next question or solution, the link icon is selected and the respective blocks are connected. This places a link or line between the two blocks.

The above steps are repeated until the desired tree is built. Blocks within a screen can freely be moved around, primarily for appearance and readability, without effecting the linking.

The use of icons is a unique method for building diagnostic trees and defining multimedia information. Prior solutions required menu selections or involved accessing other screens.

STEP 2:

To define machine specific multimedia information for any of the Q&A and solution blocks, a media icon of choice is selected on the left side of the screen of Figure 12. This media icon is placed near a Q&A or solution block of choice and is then linked to the desired block. By reselecting an assigned media icon on the right side, a media selection screen pops up as illustrated in Figure 13. Once the file is selected, there is the opportunity to

preview the material, define required additional information (i.e. page number within a documentation) and assign comment information before mapping.

This step is unique, because of the use of direct visual aids (icons) and programming to assign the media to its respective block. This process is simpler than prior solutions because everything is accomplished on one screen. media remains in its natural format and does not require any re-engineering.

STARTUP

First one turns on the computer power or reboots the system. After a few minutes (software applications are being loaded), the first screen of the system as illustrated in Figure 14 is displayed. This initial Question & Answer node is displayed on a tree display portion of the screen. This initial node requests one to select what transfer press subsystem (Feeder, Press or Destacker) has a problem. After selection in response to an initial command, additional Question & Answer screens are displayed until one reaches a solution screen or node. Details of each of the different types of screens and their operations are described hereinbelow.

QUESTION AND ANSWER SCREEN

The diagnostic screen of Figure 15 is an example of a Question & Answer (Q&A) screen. The standard Q&A screen is broken down into three major components: the question, the answer, and the placeholder. Also, in some of the Q&A screens, the Info Button is displayed, as highlighted in Figure 15, which means that there is additional multimedia information defined with the question.

QUESTION BOX

For each diagnostic screen, there is a question posted and thus must be answered. The question is typically stated in text format only.

ANSWER AREA

In the answer area, there can be two types of answers: text or graphics with text as shown in Figure 15. The next type is just a sentence as shown in Figure 7. The graphics with text type shows a picture that represents the answer. To answer a question, the correct answer (line of text or picture) is selected.

PLACEHOLDER

Once an answer is selected, a box with a picture or text, is placed in the placeholder area or branch display portion of the tree display portion of the screen. These placeholder boxes represent the diagnostic path that has been taken. Selecting a placeholder box allows one to "BACKUP" to a previous diagnostic screen.

INFORMATION

By selecting the Info Button, "i", the multimedia presentation screen pops up, as shown in Figure 9. This screen allows one to select desired media information (documentation, photographs, prints/drawings and full motion video) in response to the received user command. The multimedia information is there for the operator to help answer any questions or to explain testing or repair procedures about the current diagnostic screen.

View Screen For Text Document

The screen of Figure 17 displays a text document, which can have embedded graphics, for a respective diagnostic screen. The whole page is not displayed. To view the other portions of the page, the arrow buttons (highlighted) are selected to move about the page. To look at the previous or next page within the document, the page symbol at the right hand side of the screen is selected (as highlighted). Finally, to exit and return back to the diagnostic screen "File" is selected from the menu and then "Done" is chosen from the "File Menu."

View Screen For Drawing

The screen of Figure 18 displays an AutoCad drawing file (also called a print) and predefined views within an AutoCad file. These drawings can be an electrical, pneumatic, hydraulic or mechanical drawing. To exit the drawing, the screen is touched.

View Screen For Still Video

By selecting any of the still video (same as a photograph) buttons (the camera icon), the image is displayed in the top left side of the screen. An associated comment about the still video may be displayed above the still buttons as illustrated in Figures 16 and 19.

View Screen For Full Motion Video

By selecting any of the full motion video buttons (the video tape icon), the video image is displayed in the top left side of the screen as illustrated in Figure 20. Prior to displaying the video, a comment is displayed at the top of the box. This gives the operator the chance to determine if it is the right video to view. If not, another video button is selected. If it is the right video, the VIEW

button is selected and the VCR will start searching for the tape segment under control of the computer. Once the video is found, it is displayed in the upper left side of the screen. Volume (if speakers are attached) and brightness can be adjusted while monitoring video tape. Two other video control buttons allow the audio to be muted and the video to be frozen (the VCR is still playing at this time and only the image on the screen is frozen). To exit once the video is completed, the DONE button is selected in the video control box.

Solution Screen

When the last node, or the Solution, has been reached, the screen of Figure 21 is displayed. If there is any help information assigned at this node, the help information is displayed first. At this point, one can still back up if needed or save this particular diagnostic session in a session file (*.SES).

To save session

To save current session from the top to current node, File-Save Session menu is selected. The appropriate file name is typed in. The default file extension is (*.SES).

To restore session

To restore a previously saved diagnostic session, File-Restore Session menu is selected. Then, the session file name is selected. By restoring session, one can trace the previous path or immediately return to the solution node.

The system as described herein below diagnoses three primary components of a machine tool such as a transfer press: the press, the feeder, and the destacker. The press and the feeder diagnostic trees and related information are included. The press and feeder trees may address as many as 143 primary symptoms that include approximately 800 nodes.

Building these two trees and accumulating and assigning the multimedia information is relatively straight forward after the paper, drawings and documentation were converted into electronic format.

The method and system can be used to visually locate components on a large and complex transfer press. This has a significant impact in reducing the repair time because plant electricians can immediately locate defective component(s).

The method and system is not limited to stamping press diagnostics, but may be used for other forms of diagnostics (i.e. other plant machinery and office applications) and for use on non-machine diagnostics (i.e. process diagnostics or as engineering design aid).

The method and system provide the following advantages for use with a press: machine diagnostics when the machine is delivered; better transfer of technology and documentation from the vendor to the customer; reduced press down time; reduced diagnostic and repair time; better informed repair personnel, especially the apprentice; on-line training; better utilization of vendor/machine information; better service to the machine; the opportunity to capture new and refined diagnostic knowledge from plant personnel; reusability of information, that can be applied to other similar machines; and actual machine diagnostic flow and cause information can be captured to provide good feedback to the supplier with the hope of making better equipment and diagnostic models in the future.

The method and system can be used to provide a multi-lingual solution. Using a stereo VCR, one audio track may contain information in a first language and the other audio track may contain information in a second language. Further, a multi-lingual solution is made possible through the selection of alternate keyboard assignments using the windows operating environment.

The present system requires well disciplined and structured information management techniques to allow for ease of upgradeability, maintenance and adjustments. This

process is also invisible and seamless to the people making these changes.

The presented media information demands high storage space but can be used for other similar and identical machines. To optimize storage and decrease redundancy of information, there may be a centralized network/file server solution. While there is currently no clean way to store, retrieve and transmit analog information (video and audio) over a data network, a complete centralized library of machine information such as 2 and 3 dimensional animation, multi-language media, audible answers to diagnostic questions, speech, 3-D drawings, and a point-to-point distribution system can be accommodated when such is possible.

CLAIM

1. A method for processing and presenting multimedia information in a tree structure including branches having a plurality of nodes and node-connecting links in a computer system having tree display means for displaying nodes of the tree structure, the method comprising the steps of:

providing command display means for displaying multimedia commands representative of various types of multimedia information;

providing multimedia output means for providing multimedia information to a user of the system;

providing a knowledge base for storing a multiplicity of information records mapped into the tree structure, the information records including:

means for denoting the text strings that can be displayed on the tree display means;

means for denoting the multimedia commands that can be displayed on the command display means; and

means for denoting the multimedia information that can be presented by said multimedia output means;

receiving an initial command;

displaying at least one selected node of the tree structure including at least one text string on the tree display means in response to the initial command;

displaying a plurality of multimedia commands corresponding to the at least one selected node on the command display means;

receiving a user command related to one of the displayed multimedia commands; and

delivering a selected amount of the multimedia information to the multimedia output means to be presented thereby to the user of the system in response to the user command.

2. A system for processing and presenting multimedia information in a tree structure including branches having a plurality of nodes and node-connecting links in a computer system having tree display means for displaying nodes of the tree structure, the system comprising:

command display means for displaying multimedia commands representative of various types of multimedia information;

multimedia output means for providing multimedia information to a user of the system;

a knowledge base for storing a multiplicity of information records mapped into the tree structure, the information records including:

means for denoting the text strings that can be displayed on the tree display means;

means for denoting the multimedia commands that can be displayed on the command display means; and

means for denoting the multimedia information that can be presented by said multimedia output means;

means for receiving an initial command, the tree display means displaying at least one selected node of the tree structure including at least one text string in response to the initial command, and the command display means displaying a plurality of multimedia commands corresponding to the at least one selected node on the command display means; and

means for receiving a user command related to one of the displayed multimedia commands, the multimedia output means presenting a selected amount of the multimedia information to the user of the system in response to the user command.

3. The invention as claimed in claim 1 or claim 2 wherein the knowledge base references at least a portion of the multimedia information stored in analog form.

4. The invention as claimed in claim 1 or claim 2 wherein the knowledge base stores at least a portion of the multimedia information in digital form.

5. The invention as claimed in claim 1 or claim 2 wherein the computer system is an expert computer system.

6. The invention as claimed in claim 1 or claim 2 wherein at least a portion of the multimedia information is diagnostic information.

7. The invention as claimed in claim 1 or claim 2 wherein the at least one selected node is a question and answer node.

8. The invention as claimed in claim 1 or claim 2 wherein the nodes of the tree structure include question and answer and branch jump nodes.

9. The invention as claimed in claim 1 or claim 2 wherein the nodes of the tree structure include question and answer, branch jump and solution nodes.

10. The invention as claimed in claim 1 or claim 2 wherein the tree structure is a diagnostic tree structure.

11. The invention as claimed in claim 1 or claim 2 wherein the multimedia output means includes video display means for displaying video images.

12. The invention as claimed in claim 1 or claim 2 wherein the multimedia output means includes sound generating means for generating sound messages.

13. The invention as claimed in claim 1 or claim 2 wherein the multimedia output means includes drawing display means for displaying drawing images.

14. The invention as claimed in claim 1 or claim 2 wherein the multimedia output means includes graphics display means for displaying graphical images.

15. The invention as claimed in claim 1 or claim 2 wherein the multimedia output means includes document display means for displaying images of documents.

16. The invention as claimed in claim 1 or claim 2 wherein the knowledge base stores a multiplicity of digitized video images, each of the stored video images corresponding to one or more pieces of equipment from a predefined set of pieces of equipment.

17. The invention as claimed in claim 1 or claim 2 wherein the multimedia commands are displayed on the command display means in the form of graphic icons.

18. The invention as claimed in claim 1 or claim 2 wherein the initial command is a user command.

19. The invention as claimed in claim 1 or claim 2 wherein the tree display means, the command display means and the multimedia output means define a video display of the computer system.

20. The invention as claimed in claim 1 or claim 2 wherein the tree display means includes branch display means for displaying the selected nodes of the tree structure.

21. The invention as claimed in claim 1 or claim 2 wherein the information records further include means for denoting graphical images that can be displayed on the tree display means.

22. A method for creating a tree structure for processing and presenting multimedia information, said tree structure including branches having a plurality of nodes and

node-connecting links in a computer system having tree display means for displaying nodes of the tree structure, the method comprising the steps of:

providing a computer system, the computer system including:

command display means for displaying multimedia commands representative of various types of the multimedia information;

multimedia output means for providing the multimedia information to the system;

multimedia input means for providing the multimedia information to the system;

multimedia storage means for storing the multimedia information;

inputing the multimedia information to the computer system;

storing the multimedia information;

providing a knowledge base for storing a multiplicity of information records mapped into the tree structure, the information records including:

means for denoting text strings that can be displayed on the tree display means;

means for denoting multimedia commands that can be displayed on the command display means; and

means for denoting the multimedia information that can be presented by said multimedia output means; and

assigning the stored multimedia information to one or more of the information records.

23. A system for creating a tree structure for processing and presenting multimedia information, said tree structure including branches having a plurality of nodes and node-connecting links in a computer system having tree display means for displaying nodes of the tree structure, the system comprising:

a computer system, the computer system including:

command display means for displaying multimedia commands representative of various types of the multimedia

information;

multimedia output means for providing the multimedia information to a user of the system;

multimedia input means for providing the multimedia information to the system;

multimedia storage means for storing the multimedia information in the form of a knowledge base, the knowledge base storing a multiplicity of information records mapped into the tree structure, the information records including:

means for denoting text strings that can be displayed on the tree display means;

means for denoting multimedia commands that can be displayed on the command display means; and

means for denoting the multimedia information that can be presented by said multimedia output means; and

means for assigning said stored multimedia information to at least one information record.

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